



UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office

Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

|                    |             |                       |                     |
|--------------------|-------------|-----------------------|---------------------|
| APPLICATION NUMBER | FILING DATE | FIRST NAMED APPLICANT | ATTORNEY DOCKET NO. |
|--------------------|-------------|-----------------------|---------------------|

08/843,124 04/23/97 KAWCOP

EXAMINER

W D FASSEE  
INDIAN POND LANE  
P O BOX K  
ST ALBANS ME 04971

ART UNIT PAPER NUMBER

8

DATE MAILED:

08/11/98

This is a communication from the examiner in charge of your application.  
COMMISSIONER OF PATENTS AND TRADEMARKS

OFFICE ACTION SUMMARY

☒ Responsive to communication(s) filed on 4/16/98

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 D.C. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1 to 23 is/are pending in the application.

Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

☐ Claim(s) \_\_\_\_\_ is/are allowed.

☒ Claim(s) 1 to 23 is/are rejected.

☐ Claim(s) \_\_\_\_\_ is/are objected to.

☐ Claims \_\_\_\_\_ are subject to restriction or election requirement.

Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on \_\_\_\_\_ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☒ All ☐ Some\* ☐ None of the CERTIFIED copies of the priority documents have been

☒ received.

☐ received in Application No. (Series Code/Serial Number) \_\_\_\_\_

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of Reference Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). \_\_\_\_\_

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

Art Unit: 1763

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1, 3 thru 6, 10, 19, 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita in view of Yamamoto.

Independent claim 1 requires a method of preparing a carbon doped group III-V compound semiconductor crystal comprising the steps of: placing a raw material, solid carbon,

Art Unit: 1763

and boron oxide into a crucible; sealing the crucible within an airtight vessel formed of a gas impermeable material; heating and melting the crucible; and solidifying the melted compound.

Dependent claim 3 require the crucible to consist of pBN.

Dependent claim 4 require the boron oxide to contain water.

Dependent claim 5 require that the boron oxide contain 10-500 wt. ppm of water.

Dependent claim 6 require that the amount of the carbon placed into the crucible be larger than the amount of the carbon doped into the crystal.

Yamashita shows a method for growth III-V (GaAs) semiconductor single crystals, comprising the steps of:

Filling the crucible ( pBN) with small pieces of oxide of boron ( $B_2O_3$ ) and the raw material in an airtight vessel; heating the crucible by the heater housed in the airtight vessel; and pulling up the melted GaAs liquid from the crucible body by keeping the airtight vessel at a high pressure. ( See columns 2 thru 5 and abstract).

The moisture concentration of  $B_2O_3$  is less than 100 ppm ( See column 2, lines 34 and 35). The melted GaAs liquid is doped by carbon, and the carbon concentration is adjusted to the target concentration in the crystal ( See column 9, lines 14 to 17).

The difference between the claims and the prior art is that the crystal is that solid carbon should be introduce into the crucible to obtained a GaAs crystal doped with a carbon.

Yamamoto discloses a method of producing GaAs high resistant crystal with excellent reproducibility by intentionally adding a fixed quantity or more carbon to a GaAs crystal. The

Art Unit: 1763

carbon is weighed and introduced to a pBN crucible with Ga, As and B<sub>2</sub>O<sub>3</sub> and then melted. ( See abstract).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Yamashita method by the teaching of Yamamoto in order to obtain high electrical characteristic crystal having impurities removed.

3. Claim 2, 10, 11 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita in view of Yamamoto and Bourret-Courchesne.

Dependent claim 2 require that the B<sub>2</sub>O<sub>3</sub> should be heating and melted before contact the carbon.

Yamashita and Yamamoto show all the limitations, except that the B<sub>2</sub>O<sub>3</sub> should be heating and melted before contact the carbon.

Bourret-Courchesne teaches that the crucible temperature is first raises to a temperature greater than the melt temperature of the B<sub>2</sub>O<sub>3</sub> and the oxide is allowed to melt and form a liquid layer. Then the temperature is raised to the melting temperature of the raw material. The raw material is keep in the melted state for some time to allow reaction to occur. ( See abstract and columns 3 thru 5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Yamashita and Yamamoto method by the teaching of Bourret-Courchesne in order to eliminated random nucleation and the tendency of the semiconductor charge to stick to the crucible walls.

Art Unit: 1763

4. Claims 6 thru 9 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita in view of Yamamoto.

Dependent claims 6 and 7 require that the amount of the carbon placed into the crucible be larger ( 10 times larger) than the amount of the carbon doped into the crystal.

Dependent claims 8 and 9 require that the carbon be subjected to a heat treatment before placed into the crucible ( 1 - 12 hours, at 500°C to 2000°C at certain pressure).

Yamashita and Yamamoto show all the limitations, except that the amount of a filled carbon is larger than the amount of a doped carbon into the crystal ( a least 10-times larger); the carbon source is heated before filling the crucible ( 1 - 12 hours, at 500°C to 2000°C at certain pressure).

However, in the absence of unobvious results, it would have been obvious to one of ordinary skill in the art to determine through routine experimentation the optimum, operable heat treatment temperature of the carbon in the prior art in order to remove the impurities of the carbon to obtain a crystal of higher purity.

The amount of the carbon contain into the crucible is considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious:

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances,

Art Unit: 1763

however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality...

More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

*In re Aller* 105 USPQ 233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skilled in the art at the time the invention was made would have modified Yamashita and Yamamoto method *et al* by adding extra amount of the carbon to the crucible to promote the reaction since the reaction rates is extremely low.

Art Unit: 1763

5. Claims 12 thru 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamashita in view of Yamamoto.

Yamashita and Yamamoto show all the limitations, except the use of different types of a solid carbon.

However, in the absence of unobvious results, it would have been obvious to one of ordinary skill in the art to determine through routine experimentation the different types of solid carbon that can be use in the prior art in order to increase to contact surfaces and the velocity of the reaction. Expected beneficial results are evidence of obviousness. In re Novak 16 USPQ 2d 2041 ( Fed. Cir., BPAI 1989).

#### *Response to Arguments*

6. Applicant's arguments filed April 25, 1998 have been fully considered but they are not persuasive.

A new copy of the form 1449 dated April 25, 1997 is enclosed with this office action, reference "AE" had been initialed.

The information disclosure statement of November 6, 1997 was not in the file at the time the first office action was done.

The examiner did not consider additional references in the computer printout.

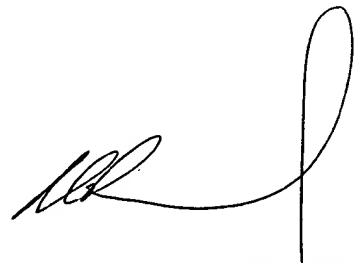
In view of the english translation of the application the Kawase article has been withdrawn as prior art.

Art Unit: 1763

Applicants' arguments with respect to claims 1 to 20 have been considered but are moot in view of the new ground(s) of rejection.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Evelyn Defillo whose telephone number is (703) 305-4635. The examiner can normally be reached on Monday thru Friday from 7:15 A.M. to 3:45 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bruce Breneman, can be reached on (703) 308-3324. The fax phone number for this Group is (703) 305-3600.



ROBERT KUNEMUND  
PRIMARY PATENT EXAMINER  
A.U. 1763

  
Evelyn Defillo

June 4, 1998